



Laser Ionization Mass Spectrometer Standard Laboratory Module (SLM™)

General Overview of the Laser Ionization Mass Spectrometer SLM

The laser ablation source mass analyzer (LASMA) is a small, field-portable unit for the rapid screening and analysis of solid and liquid samples using laser ablation techniques.

Environmental Protection Agency (EPA) Method

None applicable

Standard Analysis Method (SAM)

This SLM is a rapid turnaround screening module applicable for both organic and metals SAM systems.

Advantages

The LASMA SLM will provide a field and laboratory capability for the detection of isotopes and the measurement of isotope ratios. It provides resolution comparable to that of much larger instruments currently in

use. It will be capable of parts-per-million detection of elements. The use of LASMA requires little or no sample preparation.

General Description of the Laser Ionization Mass Spectrometer SLM

LASMA is operated by focusing a Nd YAG laser (power density $\sim 10^9$ W/cm²) on the sample surface, where it evaporates and ionizes the material. The ions that are produced are directed to the time-of-flight (TOF) mass spectrometer.

The instrument includes the following components:

- Nd YAG laser with a power supply and focusing lens
- Sample illumination and observation system that uses the same optics as the laser
- Feed system for the introduction of samples capable of handling solids or liquids

LASMA	
Mass Range	1–250 amu
Mass Resolution	≥ 200
Maximum Resolution Obtained (for Pb)	600
Relative Sensitivity of a Single Analysis	1–10 ppm
Relative Sensitivity of the Spectrum Accumulation Mode	0.1–1 ppm
Absolute Detection Limit	5×10^{-14} g
Diameter of the Focus Spot	10–50 μ m
Depth Resolution during Layer-by-Layer Analysis	0.1–3 μ m
Maximum Depth of Layer-by-Layer Analysis	≥ 1 mm
Reproducibility of Ag Isotope Ratio	10%
Laser Wavelength	1.06mm
Laser Pulse Energy	15mJ
Laser Pulse Duration	5ns
Power Density at the Focal Spot	10^{10} W/cm ²
Range of Attenuation of Laser Radiation	1–100
Overall Dimensions of the Units	9in. x 18in. x 22in.
Weight	≤ 75 kg
Power Consumption	≤ 600 W

- TOF mass spectrometer 24 cm long, with a diameter of only 10 cm, containing a 4-cm reflector
- Four metal rings used as electrostatic lenses and a three-grid section to select ions with energies lower than a specified limit
- Detector consisting of two microchannel plates.

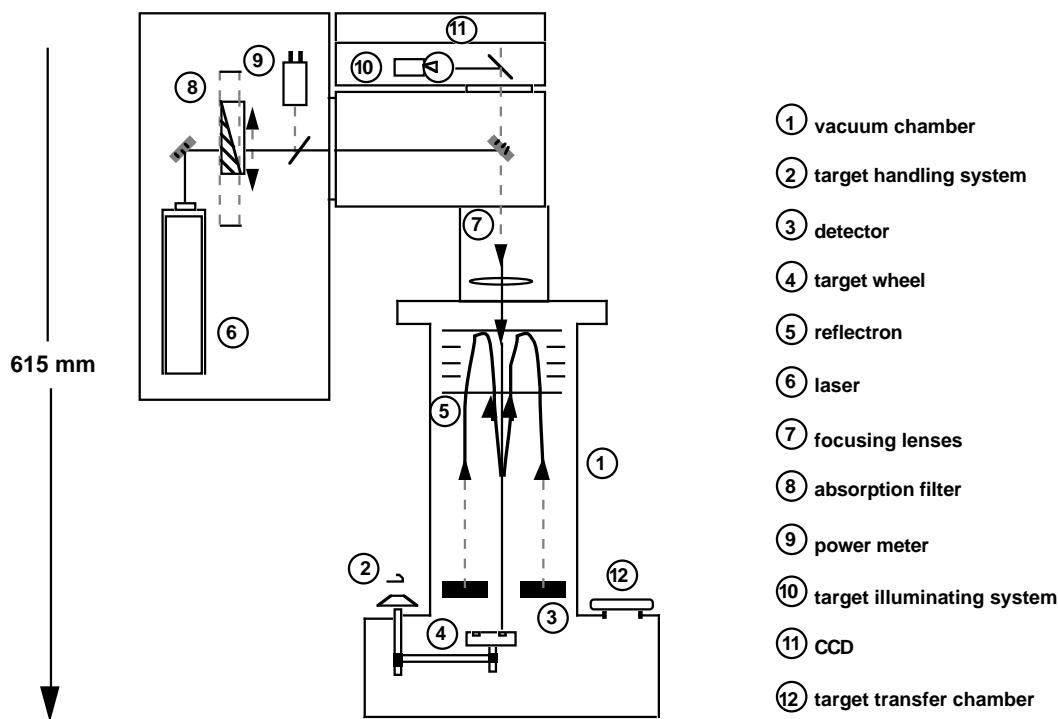


Figure 1. LASMA Architecture

Status

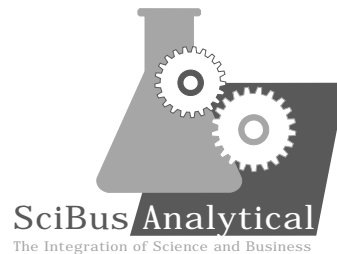
LASMA has its genesis in the Russian space exploration program and represents several years of engineering development. Development of a second-generation instrument is currently underway at ARCO Power Technologies, Incorporated. The new LASMA instrument will consist entirely of U.S. components and will have improved control and feed systems.

Industrial Partner

ARCO Power Technologies, Incorporated

Developers

ARCO Power Technologies, Incorporated;
Los Alamos National Laboratory



University of Florida
University of Tennessee
University of Texas

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